Project Title:
The Relationship between Solar Magnetic Field Changes on Various Time-Scales, Geomagnetic Activity and Energetic Particles

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Project Information:
Geomagnetic indices have been used in studies of solar-terrestrial connections for many years. For example, the long-term variation of the yearly-averaged aa index has recently been used to argue that the solar magnetic field has increased by 130% in a short period of time - the last 90 years. However, long-term averaged indices are not simple to interpret because they contain the summed contributions to geomagnetic activity from different types of solar wind structures. Furthermore, the different indices (e.g., ap, aa, Dst) reflect different aspects of the response of the magnetosphere to these structures. These indices provide the only information available to study solar wind-magnetospheric interactions over an extended period. Thus, it is important to re-investigate what geomagnetic indices can tell us about solar wind structures and the long-term global evolution of the solar magnetic field, and also their limitations. Such studies are particularly timely because of our improved understanding of the importance of coronal mass ejections to geomagnetic activity and improved ability to recognize these structures in the solar wind. Recently, we have made a preliminary examination of the contributions of coronal mass ejections, corotating streams from coronal holes, and slow solar wind to the aa index throughout solar cycle 21. We showed that one of the commonly held beliefs about the double peak in geomagnetic activity around solar maximum is not correct. We plan to extend this study to additional intervals, and attempt to use the results to examine the geomagnetic indices during the pre-spacecraft era for signatures of these various structures. We also plan to investigate the occurrence rate of large >10 MeV particle events, in particular how high particle intensities originate through a solar cycle and to what extent event intensity-time profiles can be used as a forecasting technique. This study will use archival data from Goddard experiments on spacecraft extending from the mid-1960's to present.

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Citations: